Space Weather Technical Forecast

Issued on Friday, 19 August 2022 at 01:29 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of G1/G2 Minor/Moderate geomagnetic storms on days 1 and 2 (19th/20th). Chance of further Moderate flares (R1-R2 Radio blackouts) throughout. Active electron fluence likely day 4 (22nd).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Moderate with three M-class flares observed in the past 24 hours. The largest of which was M1.6 at 18/1055 UTC from AR3078 (Dac/Beta-Gamma-Delta) in the southwest quadrant. There are currently five numbered sunspot regions and one small un-numbered region on the visible disc. AR3078 in the southwest quadrant remains the largest and most active region, displaying some strong spots, and still with a delta configuration, though some decay of penumbra has been observed recently. AR3081, now in the northwest quadrant, is the next largest region and has been responsible for several C-class flares. AR3082 and AR3083 have both shown some weakening during this period. The newly numbered AR3084 in the southeast has gradually developed to Cro/Beta, but remains stable. The remaining (un-numbered) region in the southeast is a very small and simple Axx/Alpha.
A CME associated with the M1.6 flare from AR3078 has been analysed, and is likely to miss Earth, passing to the south on the 20th into the 21st. Another CME was observed from the region of AR3078, in association with a drawn out C4.5 flare, commencing at 18/2212 UTC. This will require further analysis, when imagery becomes available to determine whether it is Earth directed, along with a CME that originated from EX3076, near the northwest limb at 18/1234 UTC.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR at L1, has been elevated to strong, between 520 and 630 km/s. Density was initially slightly above average, but has gradually lowered to average. The IMF has generally been at Moderate levels (8-15 nT) but was slightly higher at the start of the period. The north-south component fluctuated between +12 nT and -10 nT. The phi angle has largely been negative (towards the sun), with temporary switches to positive (away from the sun) from 18/0945 UTC. Parameters are indicative of an enhancement from a coronal hole high speed stream, but some influence from a CME is likely to have occurred from 18/0945 UTC. Resultant Geomagnetic activity was initially Unsettled (Kp 3), but Active to G1/Minor Storm levels from 18/1200 UTC.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV), as measured by GOES16, was at Background levels. The high energy electron flux (greater than 2 MeV) was at Background to Moderate levels, with a peak of 300 pfu at 18/1510 UTC. The 24-hour integrated electron fluence was slightly above the Active threshold at the start of the period but has decreased, dropping below this threshold at 18/0300 UTC with and observed value of 4.47e6 integrated pfu at 19/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is likely to be Low to Moderate with chance of further M-class flares and a slight chance of an X- class flare. The most likely source region for any larger flares would be from AR3078 in the southwest quadrant.

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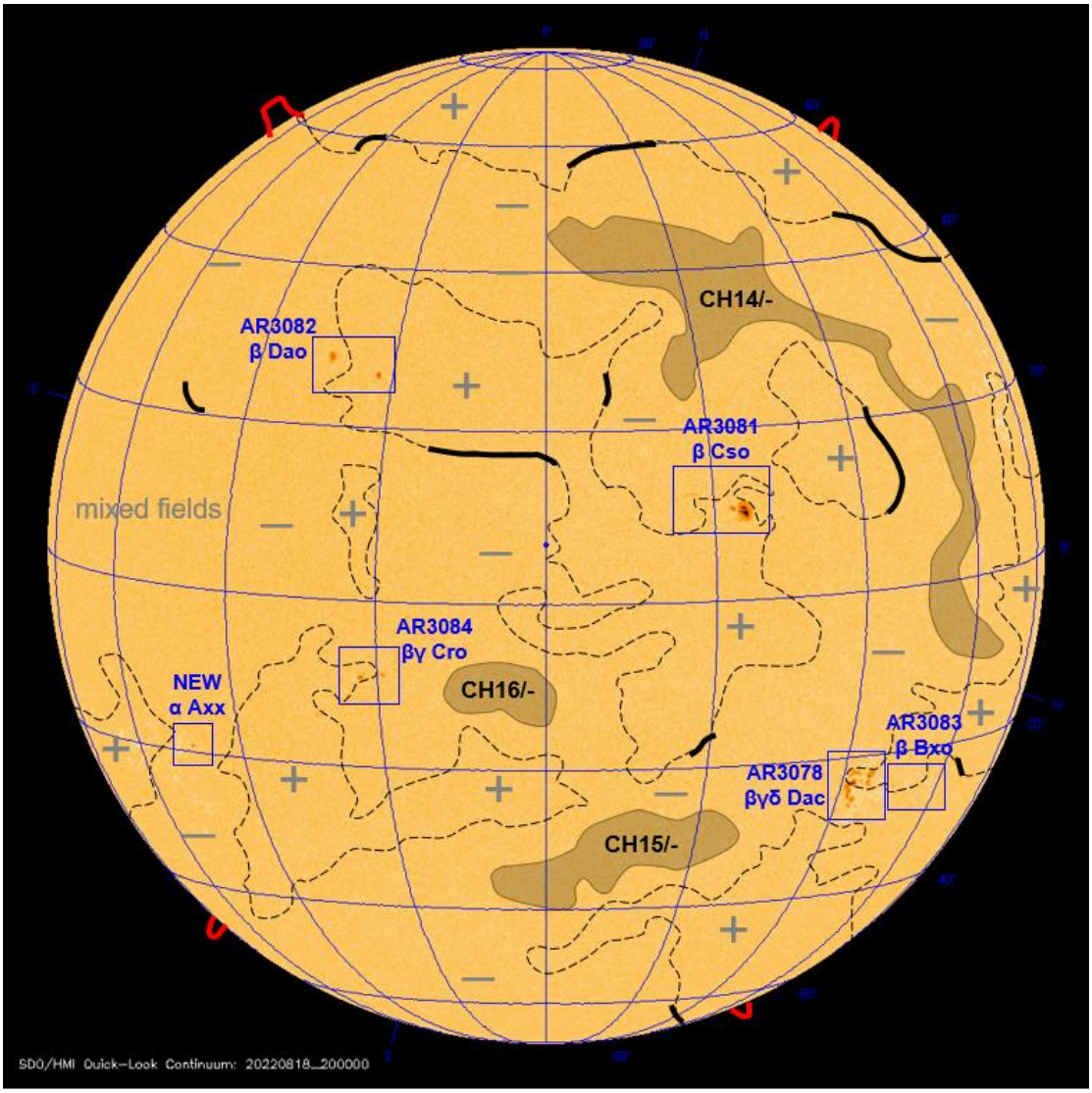
Solar Wind / Geomagnetic Activity: Solar winds are likely to remain elevated through much of this period due to coronal hole high speed stream influences. However, on days 1 and 2 (19th and 20th) they may become further enhanced, due to glancing blows from a series of CMEs. Corresponding geomagnetic activity is expected to be Unsettled to Active, with a chance of G1/Minor Storm or G2/Moderate Storm intervals on days 1 and 2 (19th and 20th). Towards the end of the period activity is likely to become predominantly Quiet to Unsettled.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is likely to remain at background levels, although there is a slight chance of an S1 or greater event, mainly due to AR3078. High energy electron flux will start will start the period at Background to Moderate levels, with ongoing CME and HSS effects. A rise to High levels is likely on days 3 and 4 (21st and 22nd) as geomagnetic activity reduces. Electron fluence values are expected to remain below the Active threshold through much of this period. However, an increasing trend is likely from day 3 (21st) and it is likely they will exceed the Active threshold on day 4 (22nd).

Figure 1. Solar Analysis Valid 18/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

Solar winds are currently elevated due to the influence of the high speed stream from coronal hole 14. They are likely to remain elevated through much of the forecast period due to coronal hole influences, although the source may transient to CH16/- later in the period. On days 1 and 2 (19th and 20th) the solar wind could become further enhanced to strong levels at times due to CME effects. A series of CMEs have left the southwester quadrant of the Sun over the past few days. The bulk of the ejected material is likely to pass south of Earth, but a few glancing blows are possible at times during days 1 and 2.
Corresponding geomagnetic activity is expected to be Unsettled to Active, with a chance of G1/Minor Storm or G2/Moderate Storm intervals on days 1 and 2 (19th and 20th). On days 3 and 4 (21st and 22nd) activity is likely to become mainly Quiet to Unsettled, with a chance of Active intervals.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	Yes	50	40	10	5
Strong	G3	No	10	5	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
16/0740	Partial Halo	AR3078	South centre disc	600	19/0001 +/-12 hours	Glancing blow possible
17/1430	Partial Halo	AR3078	Southeast	970	19/2100 +/- 12 hours	Glancing blow possible

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Radio Blackouts - X-Ray Flares:

Solar activity is currently Moderate, mainly due to activity from AR3078 (Dac/Beta-Gamma-Delta). Low to Moderate activity is expected initially, with a chance of further M-class flares. However, this is likely to reduce later in the period as AR3078 rotates round the western limb. The remaining spots on the disc are comparatively simple and thus presently don't poses the same flare risk. There's also doesn't appear to be any significant regions that are imminently going to rotate round from the far side.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	40	40	30	20
Very Active	R3 to R5 X Class	No	5	5	5	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is currently at Background levels, and is likely to remain at this level through the period. However, there is a very slight chance of an S1 or greater event. This is mainly due to AR3078 continued transit across the western hemisphere.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	10	10	10	5
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) will start the period at Background to Moderate levels. They are expected to remain at this level during days 1 and 2 (19th and 20th), as ongoing high speed stream and CME influences suppress flux levels, due to both geomagnetic effects and deformation of the van Allen belt. A rise in flux levels is then expected during days 3 and 4 (21st and 22nd), as geomagnetic activity subsides, and the high threshold (>1e3 pfu) is likely to be breached.
Corresponding electron fluence values are expected to remain below the Active threshold (1e8 integrated pfu) through much of this period. However, an increasing trend is likely from day 3 (21st) and it is likely they will exceed the Active threshold on day 4 (22nd). REFM forecast values are currently too high, and won't be taking account of the CME effects. Therefore REFM trends should not be relied upon through this period.

GEO Electron Environment	Level ($cm^{-2}\,sr^{-1}\,day^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^{8}$	Yes	10	20	40	70
Very Active	≥ 2 MeV ≥ $1x10^{9}$	No	1	1	1	5

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